

WHAT IS CLAIMED IS:

1. A wiring material comprising tungsten or a tungsten compound as a main constituent,

*para 15*  
wherein at least one inert element is include within the wiring material and argon is contained in the inert element at an amount equal to or greater than 90%, and wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

*Subt B<sup>2</sup>*  
2. A wiring material according to claim 1, wherein the tungsten chemical

10 compound is a chemical compound of: one element, or a plurality of elements, selected from the group consisting of Ta, Ti, Mo, Cr, Nb, and Si; and tungsten.

15 3. A wiring material according to claim 1, wherein electrical resistivity of the wiring material is equal to or less than 40  $\mu\Omega\cdot\text{cm}$ .

4. A semiconductor device having a wiring comprising:

*para a<sup>2</sup>*  
a metallic film comprising one element, or a plurality of elements, selected from the group consisting of W, Ta, Ti, Mo, Cr, Nb, and Si; a metallic compound film having said elements as main constituents; an alloy film of a combination of said elements; or a lamination film of thin films selected from the group consisting of said metallic film, said metallic compound film, and said alloy film,

20 wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

25 wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

5. A device according to claim 4, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

5 6. A device according to claim 4, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

7. A device according to claim 4, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

10 8. A device according to claim 4, wherein the inert element other than the argon is Xe or Kr.

15 9. A device according to claim 4, wherein internal stress of the metallic film is from  $-1 \times 10^{10}$  dyn/cm<sup>2</sup> to  $1 \times 10^{10}$  dyn/cm<sup>2</sup>.

10 10. A device according to claim 4, wherein line width of the wiring is equal to or less than 5  $\mu$ m.

20 11. A device according to claim 4, wherein film thickness of the wiring is equal to or greater than 0.1  $\mu$ m, and equal to or less than 0.7  $\mu$ m.

12. A device according to claim 4, wherein the wiring is used as a gate wiring of a TFT

13. A device according to claim 4, wherein resistance value per 1 square  $\mu\text{m}$  of surface area of a connection between the wiring and an aluminum wiring is equal to or less than  $40 \Omega$ .

5        14. A device according to claim 4, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

10        15. A device according to claim 4, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

15        16. A semiconductor device having a wiring comprising:  
              a film having tungsten or a tungsten compound as a main constituent,  
              wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and  
              wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

20        17. A device according to claim 16, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

18. A device according to claim 16, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

19. A device according to claim 16, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

20. A device according to claim 16, wherein the inert element other than the argon is Xe or Kr.

21. A device according to claim 16, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from  $-1 \times 10^{10}$  dyn/cm<sup>2</sup> to  $1 \times 10^{10}$  dyn/cm<sup>2</sup>.

22. A device according to claim 16, wherein line width of the wiring is equal to or less than 5  $\mu$ m.

23. A device according to claim 16, wherein film thickness of the wiring is equal to or greater than 0.1  $\mu$ m, and equal to or less than 0.7  $\mu$ m.

24. A device according to claim 16, wherein the wiring is used as a gate wiring of a TFT.

25. A device according to claim 16, wherein resistance value per 1 square  $\mu$ m of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40  $\Omega$ .

26. A device according to claim 16, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active

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cont

matrix type EC display.

27. A device according to claim 16, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, 5 a personal computer, or a portable information terminal.

28. A semiconductor device comprising:

a wiring having a lamination structure comprising a film having tungsten or a tungsten compound as a main constituent, and a nitride film of tungsten,

10 wherein at least one inert element is included within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

15 29. A device according to claim 28, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

30. A device according to claim 28, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

20 31. A device according to claim 28, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

32. A device according to claim 28, wherein the inert element other than the argon 25 is Xe or Kr.

*2 lines*  
33. A device according to claim 28, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from  $-1 \times 10^{10}$  dyn/cm<sup>2</sup> to  $1 \times 10^{10}$  dyn/cm<sup>2</sup>.

*Sub C 7*  
34. A device according to claim 28, wherein line width of the wiring is equal to or less than 5  $\mu\text{m}$ .

*Sub B 8*  
35. A device according to claim 28, wherein film thickness of the wiring is equal to or greater than 0.1  $\mu\text{m}$ , and equal to or less than 0.7  $\mu\text{m}$ .

*Sub C 7*  
36. A device according to claim 28, wherein the wiring is used as a gate wiring of a TFT.

*Sub C 7*  
37. A device according to claim 28, wherein resistance value per 1 square  $\mu\text{m}$  of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40  $\Omega$ .

*Sub C 7*  
38. A device according to claim 28, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

*Sub C 7*  
39. A device according to claim 28, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

40. A semiconductor device comprising:

a wiring having a lamination structure containing a silicon film having an added impurity element for imparting conductivity, a film having tungsten or a tungsten compound as a main constituent, and a nitride film of tungsten,

5 wherein at least one inert element is included within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

10 41. A device according to claim 40, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

15 42. A device according to claim 40, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

43. A device according to claim 40, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

20 44. A device according to claim 40, wherein the inert element other than the argon is Xe or Kr.

25 45. A device according to claim 40, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from  $-1 \times 10^{10}$  dyn/cm<sup>2</sup> to  $1 \times 10^{10}$  dyn/cm<sup>2</sup>.

*Sub C*

46. A device according to claim 40, wherein line width of the wiring is equal to or less than 5  $\mu\text{m}$ .

47. A device according to claim 40, wherein film thickness of the wiring is equal to or greater than 0.1  $\mu\text{m}$ , and equal to or less than 0.7  $\mu\text{m}$ .

*Sub B*

48. A device according to claim 40, wherein the wiring is used as a gate wiring of a TFT.

*Sub 10 C*

49. A device according to claim 40, wherein resistance value per 1 square  $\mu\text{m}$  of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40  $\Omega$ .

50. A device according to claim 40, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

51. A device according to claim 40, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

*Part A*

52. A semiconductor device comprising:

a wiring comprising tungsten formed over a substrate,  
wherein at least one inert element is included within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%,

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm, and

wherein internal stress of the film comprising tungsten is from  $-1 \times 10^{10}$  dyn/cm<sup>2</sup> to  $1 \times 10^{10}$  dyn/cm<sup>2</sup>.

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53. A method of manufacturing a semiconductor device having at least a wiring on an insulating surface, comprising the steps of:

Sub C17  
forming a tungsten film by a sputtering method; and  
 patterning a tungsten film.

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54. A method according to claim 53, wherein the sputtering method uses a tungsten target having a purity equal to or greater than 4 N.

15 55. A method according to claim 53, wherein the sputtering method uses a tungsten alloy target having a purity equal to or greater than 4 N.

56. A method according to claim 53, wherein the sputtering method uses only argon as a sputtering gas.

20 57. A method according to claim 53, wherein the sputtering method is performed at a substrate temperature equal to or less than 300°C.

58. A method according to claim 53, wherein the sputtering method is performed at a gas pressure from 0.1 Pa to 3.0 Pa, preferably from 1.0 Pa to 3.0 Pa.

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59. A method according to claim 53, wherein the sputtering method is performed at a gas pressure from 1.0 Pa to 2.0 Pa.

*Sub C.7* 60. A method of manufacturing a semiconductor device, comprising the steps

5 of:

forming a tungsten film on an insulating surface by a sputtering method;

and

10 patterning a tungsten film,

wherein only argon is used as a sputtering gas during the sputtering

method.

61. A method according to claim 60, wherein the sputtering method uses a tungsten target having a purity equal to or greater than 4 N.

15 62. A method according to claim 60, wherein the sputtering method is performed at a substrate temperature equal to or less than 300°C.

63. A method according to claim 60, wherein the sputtering method is performed at a gas pressure from 0.1 Pa to 3.0 Pa, preferably from 1.0 Pa to 3.0 Pa.